

Notice of Allowability

Application No.

10/693,647

Examiner

John S. Chu

Applicant(s)

JUNG ET AL

Art Unit

1752

17

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/27/03.
2. ☒ The allowed claim(s) is/are 1-21.
3. ☒ The drawings filed on 10/27/03 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 4/1/04
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

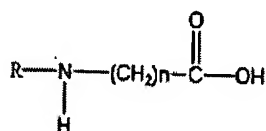
REASONS FOR ALLOWANCE

1. The following is an examiner's statement of reasons for allowance: The claimed invention is drawn to the following:

1. A method for forming a carbon nanotube pattern, comprising:
 - (a) surface treating a substrate to expose amino groups thereon;
 - (b) treating the surface-treated substrate with a linker of

aminoalkylcarboxylic acid represented by the following formula 1:

Formula 1



wherein R is a functional group capable of being dissociated by an acid, and n is an integer of 1 to 50, in the presence of a coupling agent to form amide bonds between the amino groups exposed on the substrate and the carboxyl groups of the aminoalkylcarboxylic acid;

- (c) applying a photo-acid generator onto the substrate, irradiating UV light to the substrate through a patterned photomask, and developing with an alkaline developer to form a positive pattern on which reactive amino groups are exposed; and
 - (d) reacting the reactive amino groups on the substrate with carboxylated carbon nanotubes in the presence of a coupling agent to form a carbon nanotube layer.

14. A method for forming a carbon nanotube layer, comprising:
 - (a) surface treating a substrate to expose amino groups thereon;

and

(b) reacting the amino groups of the substrate with carboxylated carbon nanotubes in the presence of a coupling agent and a catalyst to form a carbon nanotube layer,

wherein the coupling agent is O-(7-azabenzotriazol-1-yl)-N,N,N',N'-tetramethyluronium hexafluorophosphate and the catalyst is alkyl or aryl amine.

The claimed method recited in claim 1, as paraphrased by the examiner, discloses forming amide bonds between carboxylate carbon nanotubes and a substrate having amino groups that are exposed after being cleaved with a photo-acid generating compound. Step (c) applies a photoacid-generating compound on said substrate, which is then exposed and developed to leave a positive pattern having functional and reactive amino groups in the exposed areas. The subsequent step (d) covalently bonds the carbon nanotube to the substrate surface.

None of the references of record disclose the two processes recited above.

Claim 14 recites a coating process for forming a layer of carbon nanotubes on a substrate. Here again the process is forming a covalent bond between the amino groups of the substrate with carboxylate carbon nanotubes using a specific coupling agent.

None of the prior art references of record disclose the recited process of forming a layer of carbon nanotubes on a substrate as claimed.

LAVIN et al disclose forming carbon nanotube composites wherein the carbon nanotubes are reacted with a diamine, however the reference fails to disclose photolithographic process as recited in claim 1 or the forming of a layer with a specified coupler as recited in claim 14.

ZHOU et al disclose the use of depositing carbon nanotubes on a substrate, however they use a substrate having an -OH group to form a film, which is different from the amide bond forming reaction claimed here. ZHOU et al further discloses coating method of patterned carbon

nanotubes on a glass substrate, however their methods do not disclose the claimed amide bond forming method as currently claimed.

CHENG discloses patterning thick film by coating a thick film paste over a photoresist pattern. The references fails to disclose the method of forming a carbon nanotube layer as claimed.

SMITS et al disclose depositing carbon nanotubes and aligning them with an electric field. This is also different than the claimed coating method recited.

Accordingly, claims 1-21 are seen as allowable over the prior art of record and passed to issue.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. EP 1,457,821 to the same assignee discloses methods of making carbon nanotube patterns, however the publication date is after the filing date of the current application (October 27, 2003) and is not proper prior art.

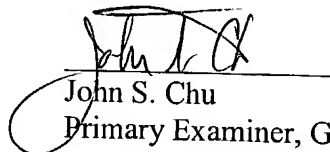
EP 1,422,563 to the same assignee and published May 26, 2004 is not prior art.

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Chu whose telephone number is (571) 272-1329. The examiner can normally be reached on Monday - Friday from 9:30 am to 6:00 pm.

The fax phone number for the USPTO is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (571) 272-1700.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PMR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


John S. Chu
Primary Examiner, Group 1700

J.Chu
December 12, 2004